

FROM McANDREWS, HELD, & MALLOY

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APPENDIX B

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DOCKET NO: 36599XZ

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

5

APPLICANT: Steven E. Koenck
SERIAL NO: 07/837,650
FILED: February 18, 1992
10 TITLE: FAST BATTERY CHARGER

ART UNIT: 2100
EXAMINER: K. Peckman

SUBSTITUTE RULE 312 AMENDMENT

15

Commissioner of Patents and Trademarks
Washington, D.C. 20231

Dear Sir:

20

Entry of this amendment after the Notice of Allowance is respectfully requested. Please substitute this amendment in its entirety for the Rule 312 Amendment filed Feb. 2, 1995.

IN THE SPECIFICATION

At page 7, line 14, please delete "FIG. 32 is" and
25 substitute --FIGS. 32A and 32B are--.

CERTIFICATION UNDER 37 CFR 1.8(a) and 1.10

I hereby certify that, on the date shown below, this correspondence is being:

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37 CFR 1.8(a)

37 CFR 1.10

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At page 1, line 1, please delete all prior paragraphs dealing with relation-back under 35 USC 120 and instead insert:

--This application is a continuation-in-part of applications Ser. No. 07/769,337 filed Oct. 1, 1991, now U.S. Patent 5,278,437, Ser. No. 07/478,180 filed Feb. 9, 1990, now abandoned, and Ser. No. 07/446,231 filed Dec. 5, 1989, now abandoned.

Said application Ser. No. 07/769,337 is a continuation-in-part of applications Ser. No. 07/544,230 filed June 26, 1990, now abandoned, Ser. No. 07/478,180 filed Feb. 9, 1990, now abandoned, and Ser. No. 07/446,231 filed Dec. 5, 1989, now abandoned.

Said Ser. No. 07/544,230 is a continuation-in-part of applications Ser. No. 07/478,180 filed Feb. 9, 1990, now abandoned, Ser. No. 07/446,231 filed Dec. 5, 1989, now abandoned, Ser. No. 07/422,226 filed Oct. 16, 1989, now U.S. Patent 4,961,043, and Ser. No. 07/266,537 filed Nov. 2, 1988, now abandoned.

Said Ser. No. 07/478,180 filed Feb. 9, 1990 is a continuation-in-part of applications Ser. No. 07/446,231 filed Dec. 5, 1989, now abandoned, Ser. No. 07/422,226 filed Oct. 16, 1989, now U.S. Patent 4,961,043, and Ser. No. 07/266,537 filed Nov. 2, 1988, now abandoned.

Said Ser. No. 07/446,231 filed Dec. 5, 1989 is a continuation-in-part of applications Ser. No. 07/422,226 filed

Oct. 16, 1989, now U.S. Patent 4,961,043, and Ser. No. 07/266,537 filed Nov. 2, 1988, now abandoned.

Said Ser. No. 07/422,226 filed Oct. 16, 1989 is a continuation-in-part of applications Ser. No. 07/266,537 filed
5 Nov. 2, 1988, now abandoned, and Ser. No. 07/168,352 filed Mar. 15, 1988, now U.S. Patent 4,885,523.

Said Ser. No. 07/266,537 filed Nov. 2, 1988 is a divisional of Ser. No. 07/168,352 filed Mar. 15, 1988, now U.S. Patent 4,885,523, which is a continuation-in-part of Ser.
10 No. 06/944,503 filed Dec. 18, 1986, now U.S. Patent 4,737,702, which is a continuation-in-part of applications Ser. No. 876,194 filed June 19, 1986, now U.S. Patent 4,709,202, and U.S. Ser. No. 797,235 filed Nov. 12, 1985, now U.S. Patent 4,716,354.

15 Said Ser. No. 876,194 is a division of U.S. Ser. No. 797,235 filed Nov. 12, 1985, now U.S. Patent 4,716,354, which is a continuation-in-part of application Ser. No. 612,588 filed May 21, 1984, now U.S. Patent 4,553,081, which is a continuation-in-part of Ser. No. 385,830 filed June 17, 1982,
20 now U.S. Patent 4,455,523.--

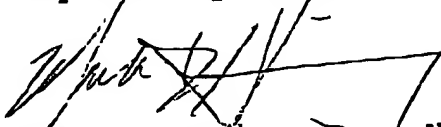
REMARKS

This amendment is being filed to correct a minor matter in the brief description of the drawings necessitated by formalization of the drawings in this application and to
25 revise the paragraph discussing § 120 relation back.

These matters are formalities only and do not represent any substantial changes that require any re-examination of the application on the merits. It is respectfully requested that these be entered.

It is not believed that any fee is due with this response. If any fee has been inadvertently overlooked please charge deposit account #26-0084.

Respectfully submitted,


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US005463305A

United States Patent [19]

Koenck

[11] Patent Number: 5,463,305

[45] Date of Patent: Oct. 31, 1995

[54] FAST BATTERY CHARGING SYSTEM AND METHOD

[75] Inventor: Steven E. Koenck, Cedar Rapids, Iowa

[73] Assignee: Norand Corporation, Cedar Rapids, Iowa

[21] Appl. No.: 837,650

[22] Filed: Feb. 18, 1992

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 4,862,013 8/1989 Konopka 320/2 X
 4,885,522 12/1989 Konopka 320/21
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FOREIGN PATENT DOCUMENTS

2520599 11/1976 Germany
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Primary Examiner—Kristine L. Peckman
 Attorney, Agent, or Firm—Zarley, McKee, Thorne,
 Voorhees, & Sease

Related U.S. Application Data

[62] Continuation-in-part of Ser. No. 769,337, Oct. 1, 1991, Pat. No. 5,278,487, Ser. No. 478,180, Feb. 9, 1990, abandoned, and Ser. No. 446,231, Dec. 5, 1989, abandoned, said Ser. No. 769,337, is a continuation-in-part of Ser. No. 544,230, Jun. 26, 1990, abandoned, Ser. No. 478,180, and Ser. No. 446,231, said Ser. No. 544,230, is a continuation-in-part of Ser. No. 478,180, Ser. No. 446,231, Ser. No. 422,226, Oct. 16, 1989, Pat. No. 4,961,043, and Ser. No. 226,537, Nov. 2, 1988, abandoned, said Ser. No. 478,180, is a continuation-in-part of Ser. No. 446,231, Ser. No. 422,226, and Ser. No. 266,537, said Ser. No. 446,231, is a continuation-in-part of Ser. No. 422,226, Ser. No. 266,537, and Ser. No. 168,352, Mar. 15, 1988, Pat. No. 4,885,523, said Ser. No. 422,226, is a continuation-in-part of Ser. No. 266,537, and Ser. No. 168,352, said Ser. No. 266,537, is a division of Ser. No. 168,352, which is a continuation-in-part of Ser. No. 944,503, Dec. 18, 1986, Pat. No. 4,737,702, which is a continuation-in-part of Ser. No. 876,194, Jun. 19, 1986, Pat. No. 4,709,202, and Ser. No. 797,235, Nov. 12, 1985, Pat. No. 4,716,354, said Ser. No. 876,194, is a division of Ser. No. 797,235, which is a continuation-in-part of Ser. No. 612,588, May 21, 1984, Pat. No. 4,553,081, which is a continuation-in-part of Ser. No. 385,830, Jun. 7, 1982, Pat. No. 4,455,523.

[51] Int. Cl.⁶ H02J 7/10

[52] U.S. Cl. 320/21; 320/31; 320/35

[58] Field of Search 320/21, 22-24, 320/31, 32, 35, 36, 39, 40, 43, 44

[56] References Cited

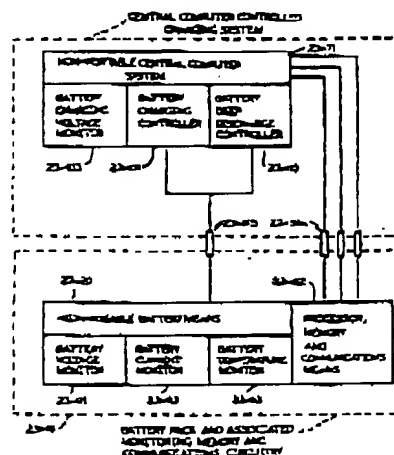
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[57] ABSTRACT

In an exemplary fast charging system, a hand-held computerized terminal with rechargeable batteries therein may be bodily inserted into a charger receptacle. The terminal may have volatile memory and other components requiring load current during charging. The system may automatically identify battery type and progressively increase charging current while monitoring for an increase in battery terminal voltage to ascertain the level of load current. The battery temperature may be brought into a relationship to surrounding temperature such that by applying a suitable overcharge current value and observing any resultant temperature increase, the level of remaining battery charge can be determined. For example, if the battery is found to be relatively fully discharged, a relatively high fast-charge rate may be safely applied while monitoring battery temperature. If the battery is initially relatively fully charged or reaches such a state during fast charge, the system may automatically switch to a lower sustainable overcharge rate selected according to battery type and temperature. A preferred system may automatically recharge the battery of a portable device according to an optimum schedule of essentially maximum safe charging rates as a function of battery temperature. The system may also convert a regulated charging current to a pulsed and modulated waveform to provide efficient net charging to the battery. The source of charging current can optionally be placed outside the terminal housing to eliminate any heat dissipation effects of the current source.

56 Claims, 33 Drawing Sheets



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